Measurement of ^{197}Au(^{11}C,xn)$^{208-x}$At Excitation Functions using a Radioactive ^{11}C Beam

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In the framework of the **BEARS**[1] Initiative (**B**erkeley **E**xperiments with **A**ccelerated **R**adioactive **S**pecies), a radioactive ^{11}C ion-beam capability has been developed at the 88-Inch Cyclotron.

Using a 125 MeV $^{11}C^{4+}$ beam we performed an experiment to measure the excitation functions in the reactions ^{197}Au(^{11}C,xn)$^{208-x}$At. The goal of this experiment is to compare the obtained excitation functions for the neutron deficient projectile ^{11}C to the predictions of fusion evaporation codes (e.g. ALICE[2], PACE[3]) and to previously measured ^{197}Au(^{12}C,xn)$^{209-x}$At excitation functions [4,5].

The experiment was performed in 'batch-mode', i.e., the activity was produced at the Biomedical Isotope Facility and then transported by hand to the 88-Inch Cyclotron for injection and acceleration. For each batch, beam intensities of several 10^7 $^{11}C^{4+}$ ions/sec were obtained over a period of at least 20 minutes.

In each measurement, thin (250 $\mu g/cm^2$) gold targets were bombarded by ^{11}C ions. After irradiation each target foil was moved between a set of two 450 mm^2 silicon detectors to observe the α-decays of astatine isotopes.

Fig. 1 shows a typical α spectrum. Besides the α-decay groups of the astatines, the decay lines of polonium isotopes can also be observed. These are predominantly due to the decay of the EC daughter nuclei of astatine isotopes.

The observed resolution is primarily due to the energy loss of the a-particles in the 250$\mu g/cm^2$ gold targets.

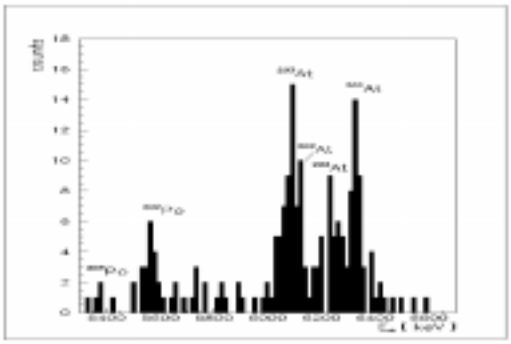

Fig. 1. Measured α-spectrum at T= 90 MeV.

To perform the excitation function measurement the initial beam energy was varied by a set of aluminum degrader foils. Furthermore, aluminum foils of 25 μm thickness were mounted between the three target foils used in our setup to degrade the beam energy in steps of ~10 MeV.

Fig. 2 shows the preliminary excitation function for the ^{197}Au(^{11}C,7n)^{201}At reaction in arbitrary units compared to ALICE[2] predictions. The normalization of the data is done by measuring ^{11}C ions elastically scattered by a thin gold foil. The elastic telescope was calibrated by collecting the ^{11}C ions on a catcher and measuring the collected activity.

The final analysis of the data, including the exact determination of the detector efficiencies, will be finished in early 1999.

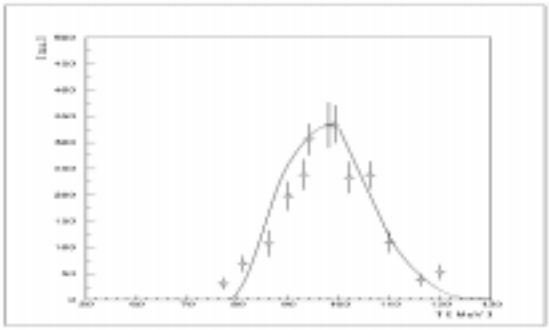

Fig. 2. Excitation function in the reaction ^{197}Au(^{11}C,7n)^{201}At. The solid line represents the ALICE[2] predictions normalized to the data.

Footnotes and References

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[1] see special contributions to this report.

[2] M. Blann and J. Bisplinghoff, LLNL Report No. UCID-19614, 1982.

[3] A. Gavron, Phys. Rev. C **21**, 230 (1980).

[4] R. Bimbot et al., Journal de Physique **29**, 563 (1968).

[5] J.D. Stickler et al., Phys. Rev. C **9**, 1064 (1974).